

CLAIMS

1. A method for producing enzyme granulates, characterized in that
 - a. one or more liquid enzyme formulations are injected via nozzles primarily in a solid-laden gas stream,
 - b. moistened material particles in the heated gas stream are subjected to a drying and granulation process,
 - c. after a residence time, the particles are separated from the gas flow and returned into the processing chamber,
- 10 d. the particles are placed into the gas entry area,
- e. fine particles, dust, and particles entrained by the processing gas are separated and returned to the process in the form of seed material for the formation of granulate, and
- f. through material return into the gas stream, a circular flow of solid matter is formed arranged in an axial direction of the reaction chamber.
- 15
2. A method for producing enzyme granulates, in particular according to claim 1, characterized in that
 - a. one or more liquid enzyme formulations are injected via nozzles into the gas flow laden with solid matter,
 - b. the moistened material particles are subjected to a drying and granulation process in the heated gas flow,
 - c. after a residence time the particles, separated from the gas flow, are returned into the processing chamber,
 - 20 d. the particles are guided via sloped surfaces through gravity to the gas entry area,
 - 25

e. fine particles, dust, and particles entrained by the processing gas are separated and returned to the process in the form of seed material for the process for forming granulate,

f. a circular solid matter flow is created, positioned in the axial direction of the reaction chamber, by introducing material into the gas flow via opening gaps which are preferably rotationally symmetrical or elongated.

5 3. A method according to claims 1 or 2, in particular according to claim 2, are characterized in that the enzyme granulates are removed from the
10 processing chamber by a sifting device.

4. A method according to one of claims 1 through 3, in particular according to claims 2 or 3, characterized in that the enzyme granulates are removed from the processing chamber via volumetric removal units.

15 5. A method according to one or more claims 1 through 4, in particular according to one of claims 2 through 4, characterized in that enzyme granulates removed from the process that are too small or too big are separated from the finished goods.

20 6. A method according to one or more of the claims 1 through 5, in particular according to one of claims 2 through 5, characterized in that enzyme granulates removed from the process that are too small are returned into the processing chamber as seed material.

7. A method according to one or more of claims 1 through 6, in particular according to one of claims 2 through 6, characterized in that enzyme granulates removed from the process that are too large are milled by a milling device and returned into the processing chamber as seed material.

5

8. A method according to one or more of claims 1 through 7, in particular according to one of claims 2 through 7, characterized in that the enzyme granulates returned to the processing chamber are thermally retreated.

10 9. A method according to claim 8, characterized in that the enzyme granulates returned into the processing chamber are dried or preheated.

10. A method according to one of claims 1 through 9, in particular according to one of claims 2 through 9, characterized in that the enzyme 15 granulates returned into the processing chamber are milled.

11. A method according to one of claims 1 through 10, in particular according to one of claims 2 through 9, characterized in that enzyme granulates are made from various additives and in various mixing ratios.

20

12. A method according to one of claims 1 through 11, characterized in that the material particles are subjected to a granulation process after prior spray drying.

25 13. A method according to one of claims 1 through 12, characterized in that 1 % by weight or more, preferably 5 to 20 % by weight of a powdery ready-

made granulation product, produced according to one of the previous claims 1 through 12 and/or otherwise produced enzyme particles and/or one or more enzyme containing intermediate products selected from enzyme containing powder or dust, is added to the granulation process.

5

14. A method according to one or more of claims 1 through 13, characterized in that the enzyme granulates produced are coated in a subsequent step by coating with a water-protecting layer.

10 15. A method according to one or more of claims 1 through 14, characterized in that an average value of the residence time of the enzymes in the heated processing chamber amounts to less than 1.5 hours, preferably less than 0.5 hours.

15 16. A method according to one of claims 1 or 2, particularly according to one of claims 3 through 15, characterized in that preferably before or particularly simultaneously to or after step a., as mentioned in one of claims 1 or 2, or during the granulation process, fine-grained to coarse particular material, preferably inert particular materials is added as the seed material for 20 the drying and granulation process.

25 17. Enzyme granulates produced according to one of claims 1 through 15 or 16, having a roundness factor of 1 to 1.6, an average grain size D50 of 60 (in particular 100) to 2000 μm , characterized in that (i), wherein when the content of the active enzyme in reference to a sum of active and inactive enzyme content amounts to more than 85 %, the average grain size D50 lies in the

range from 650 to 2000 μm , (ii) wherein when the portion of the active enzyme, as defined above, is more than 88 %, the average grain size D₅₀ is in the range from including 470 to less than 650 μm , (iii) wherein when the portion of the active enzyme, as defined above, is more than 91 %, the average grain size D₅₀ is at 230, including to less than 470 μm , and (iv) wherein when the portion of the active enzyme, as defined above, amounts to more than 95 %, the average grain size D₅₀ ranges from 60 to less than 230 μm , and the residual moisture is below 5 % by weight.

10 18. Enzyme granulates according to claim 17, in particular referring to one of claims 1 through 15 or to claim 16, characterized in that a weight ratio of inactive material including inactive enzyme in reference to active enzymes amounts to less than 7 : 1 in reference to a dry weight.

15 19. Enzyme granulates produced according to one of claims 1 through 15 or 16, in particular an enzyme granulate according to claim 18, having an average grain size of 60 through 800 μm , characterized in that a dust content according to the Heubach test is less than 800, in particular less than 500 ppm.

20 20. Enzyme granulates according to one of claims 17 through 19, characterized in that a pressure resistance of the enzyme granulates is equal or more than 10 MPa, preferably 20 to 50 MPa.

25 21. Enzyme granulates according to one of claims 17 through 20, characterized in that a grain size distribution of the enzyme granulates, defined by a ratio of d₁₀/d₉₀, is equal or greater than 0.4.

22. Enzyme granulates according to one of claims 17 through 21, characterized in that a bulk density of the enzyme granulate is equal or greater than 500 g/l, preferably 550 to 850 g/l.

5

23. Enzyme granulates according to one of claims 17 through 22, comprising phytase as an enzyme, characterized in that the phytase activity of the enzyme granulates is equal or greater than 15 000 FTU/mg.

10 24. The use of an enzyme granulates according to one of claims 17 through 21, in particular to the extent they are referring to one of claims 1 through 15 or claim 16, as an addition or a sole effective component in the production of formulations for food, cleaning, or pharmaceutical purposes.

15 25. The use according to claim 24 for the production of feed.

26. The use according to claim 24 for the production of food.

27. The use according to claim 24 for the production of a laundry or
20 dishwashing detergent.

28. The use according to claim 24 of enzyme granulates according to one of claims 22 or 23, in particular to the extent they refer to one of claims 1 through 15 or claim 16, as addition or sole effective agent in the production of
25 formulations for food, cleaning, or pharmaceutical purposes.

29. The use according to claim 28 for the production of feed, food or a laundry or dishwashing detergent.

30. A method according to one of claims 1 or 2, in particular according to
5 one of claims 3 through 15 or 16, characterized in that during the drying and granulation process or during parts of the processes one or more inert materials are added as core or seed material and/or as an addition into the enzyme granulate matrix or parts therefrom for diluting the enzyme or enzymes.

10

31. A method according to claim 30, characterized in that the inert material or materials are added as solid matter, within the enzyme solution and/or in one or more solutions, suspensions or melts, each separate from the enzyme solutions.

15

32. A method according to one of claims 30 or 31, characterized in that one or more solutions and/or suspensions of the inert material or materials is atomized via one or more separate nozzles in addition to the nozzle or nozzles for atomizing the liquid enzyme formulation during the drying and granulation
20 process or parts therefrom.

33. A method according to one of claims 30 through 32, characterized in that one or more material nozzles and a gas for atomizing one or more solutions or suspensions of one or more inert materials are used.

25

34. Enzyme granulates with the features according to one of claims 17 through 24, produced according to the method according to one of claims 30 through 33.

5 35. The use of enzyme granulates according to claim 34 for the production of feed, for the production of food, or for the production of a laundry or dishwashing detergent.